

Cahier 2003-02

Inter-temporal Price Discrimination when Imports are Restricted by Quotas

HOLLANDER, Abraham

MACDISSI, Charbel

Département de sciences économiques

Université de Montréal

Faculté des arts et des sciences

C.P. 6128, succursale Centre-Ville

Montréal (Québec) H3C 3J7

Canada

<http://www.sceco.umontreal.ca>

SCECO-information@UMontreal.CA

Téléphone : (514) 343-6539

Télécopieur : (514) 343-7221

Inter-temporal Price Discrimination when Imports are Restricted by Quotas

by

Abraham Hollander
University of Montreal
Centre for Transportation Research

and

Charbel Macdissi
U.F.R. des Sciences Juridiques et Économiques de la Guadeloupe
Université des Antilles-Guyane
Centre d'Études et de Documentation Européenne

February 2003

Abstract: A dominant firm holding import quota engages in inter-temporal price discrimination when facing a competitive fringe engaged in seasonal production. This causes a welfare loss that comes in addition the loss attributable to limitation of imports below the free trade level.

JEL classification: F12, F13

Keywords: quota, monopoly, discrimination, dominance, dynamic.

Correspondence should be addressed to : Abraham Hollander, Department of Economics,
University of Montreal, POB 6128, Station " Centre-Ville", Montreal, QC, H3C 3J7,
Canada. Phone (514) 343 7214, Fax (514) 343 7221, e-mail :
hollande@poste.umontreal.ca

Introduction

An extensive literature focuses on the welfare effects of import quotas under imperfect competition. The most basic finding is that under monopoly quota restrictions are more costly from a welfare perspective than tariffs. One reason is that quotas, unlike tariffs, do not set a ceiling on the domestic price.¹ Another reason is that monopolistic firms may underutilize quota that a competitive sector would utilize fully.² Also, in an oligopolistic environment imposition of a quota may raise prices and profits by acting as facilitating practice- i.e., a practice that facilitates collusion.³

A feature common to all this literature is that conclusions are drawn from one-period models. Such framework rules out the possibility that quota unused in one period will be exploited in a subsequent period. For that reason, these models cannot address the question how monopoly compares to competition in terms of the choice of a time path of quota utilization. This requires a dynamic model.

The literature on quotas in a dynamic context is still sparse. Anderson (1987) and Krishna and Tan (1996) explore time paths of quota uses and prices when quota value changes over time due to random shocks. Quota holders postpone the utilization of quota when expected future quota value exceeds current value. However, these papers do not consider the role of market. A paper which does, is Miyagiwa and Ohno (2001). It examines the time path of quota utilisation in a stationary market where a domestic

The authors thank H. Bowen, L Dudley and J-M Viaene for their comments and suggestions.

¹ see Bhagwati (1965, 1968) for the case of domestic monopoly and Shibata (1968) for a foreign monopoly.

² In fact, a monopoly may purchase more quota than it actually uses. See Hillman et al. (1980)

³ Harris (1985) and Krishna (1992)

producer faces a quota-constrained importer. They show that when future profits are not discounted too heavily, imports increase within the time interval in which the import license remains valid. This occurs because the quota serves as a mechanism that facilitates a more collusive outcome.

What motivates this paper is the complaint articulated by an Ecuadorian official that firms holding the lion's share of the import quota to selected agricultural products have "this deplorable penchant" to flood the market with "excessive amounts" of foreign product at times when home growers harvest the domestically grown substitute. This results in a lower local price during harvesting season - an effect the official attributes to growers' inability to store the harvested product. Because growers base their forecast of future prices on past prices, there also ensues a reduction in domestic production. Quota holders are few and imports often account for a very substantial share of local consumption.

This paper gives formal meaning to the expression "excessive imports". It explores whether the alleged behaviour is rational on the part of a dominant importer. It does so in the framework of a parsimoniously specified 2-period. It finds that profit maximization does indeed give rise to excessive imports during harvesting season, showing that for a given amount of cumulative imports, strategic behaviour by the importer reduces welfare. The importer engages in inter-temporal price discrimination. The welfare loss results from a lowering of cumulative consumption and from the misallocation of imports across

periods. The paper also explores whether a similar result obtains when import licenses are sold rather than given away for free.

2. The model

There is a two-period production-consumption cycle with periods labelled 1 and 2. Consumer demand for the homogeneous good is met through imports and domestic supply. Imports can enter the country in each period. Domestic supply originates from a competitive fringe of firms producing only in period 1.

The good cannot be stored. Therefore, the quantities consumed in the two periods are $S + q_1$ and q_2 , where q_i denotes imports in period i [$i = \{1,2\}$] and S denotes supply by the fringe. Because storage is impossible, domestic supply responds only to the price of period 1.

The inverse demands are

$$p_1 = D[S(p_1) + q_1] \quad (1)$$

and
$$p_2 = D[q_2] \quad (2)$$

where p_i denotes the price prevailing in period i . Also, $D' < 0$ and $S' > 0$. The sum of imports in period 1 and 2 – called cumulative imports- is limited by the quota Q which is sufficiently restrictive to ensure that

$$q_1 + q_2 = Q \quad (3)$$

Conditions (1)-(3) imply that the optimal allocation of imports across periods satisfies

$$p^* = D[S(p^*) + q_1^*] = D[q_2^*] \quad (4)$$

subject to (3). This requires $S(p^*) + q_1^* = q_2^*$.

The allocation given by (4) obtains when importers are price takers in the product market.

This allocation is set against the allocation chosen by a single firm that holds all the import licenses. That firm is assumed to be a dominant player in the sense of being a first mover.⁴

The dominant firm utilizes quota to maximize $p_1 q_1 + p_2 q_2$. This requires equalization of marginal revenues across periods.⁵ Specifically, it requires that

$$D[S(p_1^d) + q_1^d] + \frac{q_1^d D'[S(p_1^d) + q_1^d]}{1 - D'[S(p_1^d) + q_1^d] S'(p_1^d)} = D[q_2^d] + q_2^d D'[q_2^d] \quad (5)$$

where $q_1^d + q_2^d = Q$ and, $p_1^d = D[S(p_1^d) + q_1^d]$ ⁶.

⁴ This is the classical textbook model of the dominant firm facing a competitive fringe. The dominant firm is assumed to repeat the same strategy over infinite number of cycles.

⁵ The assumption of a zero price for imports simplifies notation but does not affect any result.

⁶ To derive (4) use has been made of (1) to obtain $dp_1/dq_1 = D'/(1 - D'S')$

Using (4), $q_1^* < q_2^*$ and $(1-D'S) > 1$, it is straightforward to show that welfare maximizing requires that the importer's marginal in period 1 be larger than in period 2. Formally,

$$D[S(p^*) + q_1^*] + \frac{q_1^* D'[S(p^*) + q_1^*]}{1 - D'[S(p^*) + q_1^*] S'(p^*)} > D[q_2^*] + q_2^* D'[q_2^*] \quad (6)$$

The implication is $q_1^d > q_1^*$ and $q_2^d < q_2^*$.⁷ Thus, the dominant firm imports more than a competitive import sector would during the period when which domestic production takes place. There are two reasons: First, for any quantities $S + q_1 = q_2$, the derived demand is less steep than the demand in period 2.⁸ Second, $q_1^* < q_2^*$.

The inability to store allows the importer to act like a monopoly engaged in third degree price discrimination. However, the welfare implications are different. Under standard third degree price discrimination, welfare could be higher or lower than under uniform pricing. The reason is that the welfare gain from an increase in output could outweigh the loss resulting from the creation of a price wedge across markets.⁹ There is no such trade-off here. Because the dominant firm imports a larger quantity in period 1 than under uniform pricing, p_1 is lower than price under uniform pricing.¹⁰ Therefore domestic

⁷ This conclusion hinges on marginal revenue being decreasing in quantity. This follows from the second order condition.

⁸ This follows from $D' < D'/(1-D'S)$.

⁹ see Tirole (1988)

¹⁰ If the period immediately following the grant of quota is the harvesting period, then discounting future earnings would yield an even lower p_1 . The reason is that the dominant importer would equalize marginal revenue from period 1 imports with the discounted marginal revenue from period 2 imports. Discounting would have the opposite effect if the importer acquired the quota at the beginning of period 2.

supply is also lower. Thus, cumulative consumption is also lower than under uniform pricing. Clearly, the reduction in local production magnifies the welfare loss caused by the inter-temporal price gap.

3. A graphical illustration

Figure 1 displays consumer demands for periods 1 and 2 as well as the fringe supply, the period 1 derived demand and, marginal revenues.

Insert figure 1.

The import quota is shown as the distance between E and Z. Efficient allocation has with imports equal to HZ in period 1 and EH in period 2. The corresponding price is p . When the quota is held by a single firm, period 1 imports are TG and period 2 imports are FT (TG=VN). Prices are p_1 and p_2 . Compared to uniform pricing, there is a loss in period 2 consumer surplus equal to the area RSHE and a gain in period 1 equal to the area HMNK.¹¹ Producers' loss in surplus is the area HBVK. Discrimination increases the value of the quota by the area SRHU minus the area HJK. The latter is as large as VYXN. Therefore, the total welfare loss due to discrimination is the sum YBV+(MXN+SEU). Its first component is the loss due to lower production; the second component is the a loss attributable to the misallocation of consumption.

¹¹ It is obvious that cumulative consumer surplus is lower than under uniform pricing. Because the cumulative quantity is smaller than under uniform pricing, consumer surplus is lower than when the price is p even if the smaller quantity were sold at non-discriminatory prices.

4. Final remarks

In the presence of seasonal production by fringe producers, allocation of import licenses to a single importer causes welfare to fall due to inter-temporal discriminatory pricing, although quota is fully utilized.

This result does not hinge on the assumption that all quota is held by a single firm. The outcome would be the same in qualitative terms, if quota were held by a small import oligopoly. However, welfare losses would be smaller than under a single importer because the gap between demand and “perceived” marginal revenue would be smaller.

A government that auctions quota could, in principle, maximize revenue by selling all licenses to a single importer. This, however, requires that all licenses be offered on an all-or-nothing basis to the highest bidder.¹² A sale of a quota in small lots bars the type of discrimination shown in this model. The reason is simple. Consider e.g., the last lot offered for sale and assume that all previously sold lots have been acquired by a one firm. The maximum amount that such firm would pay for the last lot is the contribution to marginal revenue; the maximum amount an outsider would pay is the price prevailing in the period when there is no production. Because price in that period exceeds marginal revenue, an outsider can outbid the large importer. The same reasoning applies equally to the second-to-the-last lot, the third-to-the-last lot, etc.. The implication is that welfare

¹² Whether or not doing so actually maximizes revenue depends on the number of firms that would bid for the entire quota. When the number of bidders increases as lot sizes fall, revenue maximization may require that the amount of quota be sliced up and that slices be auctioned separately.

losses shown in the paper hinge crucially on quota being given freely to a small number of importers or, being auctioned in large lots.

References

- Anderson J.E. 1987. Quotas as options: Optimality and quota license pricing under uncertainty. *Journal of International Economics*, 23, 21-39.
- Bhagwati.J. 1965. On the equivalence of tariffs and quotas, In R.E. Baldwin et al., *Trade Growth and the Balance of Payments*, Chicago: Rand McNally, 52-67.
- Bhagwati J. 1968. More on the Equivalence of tariffs and quotas, *American Economic Review*, 58, 142-6.
- Harris, R. 1985. Why voluntary export restraints are “voluntary”, *Canadian Journal. of Economics*, (4), 799-09.
- Hillman A.L., E. Tower and G. Fishelson, 1980. On water in the quota, *Canadian Journal. of Economics*, vol. XIII(2), 310-16.
- Krishna, K. 1992. Trade restrictions as facilitating practices, in G.E. Grossman ed. *Imperfect competition and international trade*, MIT Press, Cambridge, MA and London. England.
- Krishna K., Ling Hui Tan, 1996. The dynamic behavior of quota license prices, *Journal. of Development Economics*, vol. 48, 301-21.
- Shibata, H. 1968. A Note on the equivalence of tariffs and quotas’ *American Economic Review*, 58, 137-42.
- Miyagiwa K., Ohno Y. 2001. Quota-induced cycles, *International Economic Review*, vol. 42, no2, 451-472.
- Tirole J. 1988. *The Theory of Industrial Organization*, MIT Press, Cambridge MA and London (England)

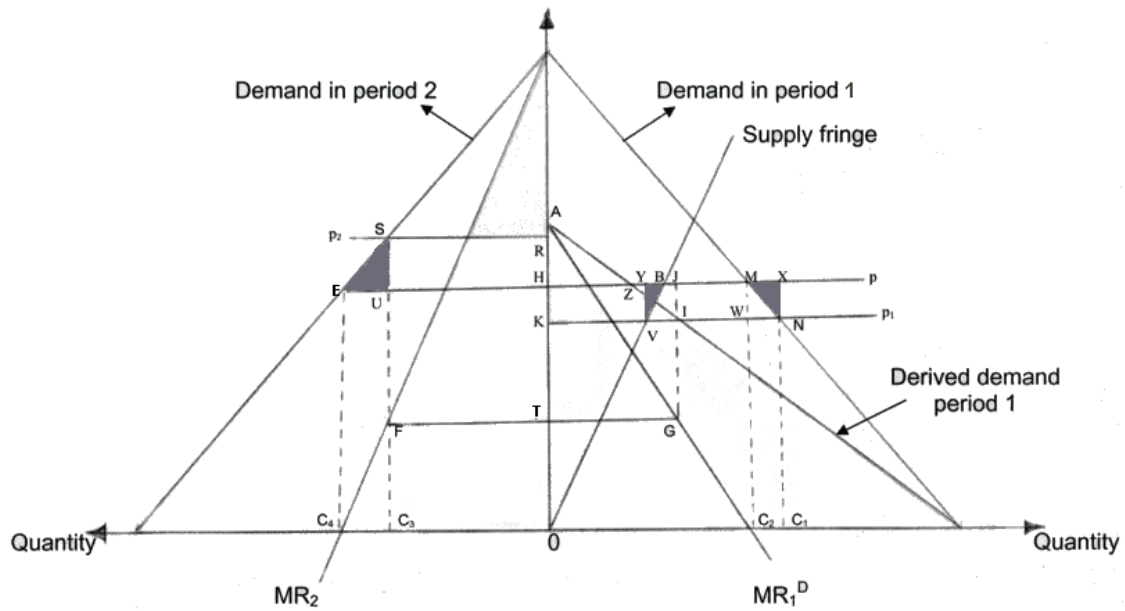


Figure 1
Quota Allocation Across Periods